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FEDERAL COMMUNICATIONS COMMISSION
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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/ 2483.5-2500 MHz Frequency Bands	)	CC Docket No. 92-166

REPLY COMMENTS
OF
AMSC SUBSIDIARY CORPORATION

AMSC Subsidiary Corporation ("AMSC") hereby submits its reply to the comments submitted on the Notice of Proposed Rulemaking (the "NPRM") issued by the Commission in the above-referenced docket. FCC 94-11 (February 18, 1994). AMSC is principally concerned with the Commission's proposal to exclude systems deploying satellites in geostationary orbit ("GSO systems") from the newly-allocated 1.6/2.4 GHz Mobile Satellite Service ("MSS") bands and limit licensing of the new spectrum to non-GSO systems. This reply pleading will focus on those comments that addressed the GSO exclusion.

As discussed below and in AMSC's initial comments, the record in this proceeding continues to demonstrate that GSO systems are at least the equal of non-GSO systems. GSO systems have virtually all the technical capability of non-GSO systems, including the ability to provide global coverage more efficiently and a superior ability to provide dispatch-type services. The record also demonstrates that non-GSO systems face substantial hurdles before they will be able to offer service. These hurdles

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include unresolved inter-service sharing issues for both mobile links and feeder links, a difficult international political environment, and extremely high capital costs to build the various systems.

AMSC's plea to the Commission is that it "hedge its bets" in the 1.6/2.4 GHz band by permitting AMSC's GSO proposal to remain eligible to use the spectrum. There is precious little spectrum for MSS and AMSC's GSO system is uniquely able to put the 1.6/2.4 GHz spectrum to use inexpensively and without resolution of many of the inter-service sharing issues that confront global non-GSO systems. For instance, AMSC's GSO system faces none of the severe feeder link problems that characterize the prospects of the non-GSO systems. Moreover, AMSC can operate in the 1.6/2.4 GHz bands using Code Division Multiple Access ("CDMA"), and thereby share the spectrum with non-GSO systems that also use CDMA. Thus, the FCC can hedge its bets in this proceeding without impairing the ability of the non-GSO proponents to go forward.

The non-GSO applicants for the 1.6/2.4 GHz band all submitted comments supporting the proposed disqualification of GSO systems. Several cite the allegedly unique abilities of non-GSO systems to provide global coverage. As AMSC has shown, however, as few as three GSO satellites can provide coverage to all but the highest latitudes, and the Commission has proposed to not to include coverage of these polar areas as qualifying criteria. As Comsat notes, the Inmarsat and Intelsat systems provide global service using geostationary satellites. Comments of Comsat, p. 9. AMSC expects that it will participate itself in the globalization of MSS technology, starting initially with the more financially sound approach of launching a satellite to serve the United States and North America, where the market is greatest.

The non-GSO proponents also cite the alleged time-delay problem experienced by GSO systems with their satellites in higher orbit. Comments of LQP, p. 12; Comments of TRW, p. 18. Again, however, the true picture is far less stark. As discussed in the attached Technical Appendix, there will be no significant qualitative or quantitative difference in the time delay experienced by users of GSO and non-GSO systems.

One non-GSO applicant argues that GSO systems are restricted to serving large platforms capable of supporting antennas operating at 10 watts or more. Comments of Constellation, p. 7. In fact, AMSC's first generation system will provide service to standard mobile terminals that will operate with no more than 5 watts of power and AMSC's second-generation system will be capable of providing service to hand-held terminals.[1/]

1/ As AMSC noted previously, although its second generation system will have the capability to provide service to handheld mobile terminals, AMSC does not believe that the Mobile Satellite Service market for hand-helds is substantial, since potential MSS users in rural areas will be located in or near vehicles and service to handheld terminals is inherently limited in its ability to provide service inside buildings and at other urban and suburban pedestrian locations. Thus, AMSC believes that many customers will prefer to use a vehicular terminal with a "docking station" into which they will plug their handheld terrestrial mobile radio. TRW misunderstands this characterization of the market when it contends that
(continued...)

Constellation also claims that non-GSO systems offer greater reliability, because they have a larger number of satellites. Comments of Constellation, p. 8. In fact, as AMSC has discussed previously, a GSO system such as that of AMSC is far more reliable than the non-geostationary systems that have been proposed. Comments of AMSC, pp. 19-27. Geostationary satellites themselves are extremely reliable and have relatively long useful lives of ten years or more. AMSC's system also is designed to have back-up and restoration from the Canadian satellite in the unlikely event of a catastrophic failure. In contrast, none of the non-GSO systems have back-up satellites in position and the probability is much higher that a user will not be able to communicate with the non-GSO systems due to line-of-sight, power margin availability or other problems.

Ellipsat claims that AMSC's continued eligibility as a GSO system proponent will cause severe capacity limitations for the non-GSO systems, but it makes no showing to support this contention. Comments of Ellipsat, p. ii. As AMSC has demonstrated and as has been agreed to in the Negotiated Rulemaking process, there is no penalty to having a GSO system

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1/(...continued)
customers of AMSC's second generation system will need to rely on these "booster" units. Comments of TRW, p. 19. AMSC's customers will be able to use hand-held terminals if they choose; AMSC simply does not expect the hand-held market to be substantial. AMSC believes that the non-GSO proponents will arrive at the same conclusion when they begin to appreciate the severe power limitations that they will experience even at low Earth orbit trying to provide service to handhelds in typical pedestrian locations.

share with non-GSO systems if all systems involved operate using CDMA.[2/]

Several non-GSO proponents also challenge AMSC's claim that it needs additional spectrum. Comments of Constellation, p. 14; Comments of Ellipsat, p. 21; Comments of Motorola, p. 33. As the Commission acknowledged just recently, however, there is a clear need for additional MSS spectrum. Memorandum Opinion and Order, Gen Docket No. 90-314, FCC 94-144 (June 13, 1994). With so little spectrum available, the Commission should not take the risk of wasting it when AMSC has shown that it has a practical plan to put the spectrum to good use. The public interest benefitted from the continued eligibility of any system that can provide service to the American public without impinging on the ability of others to enter the market.

Several of the comments echoed AMSC's point that the non-GSO systems still have substantial barriers to overcome before their systems become a reality. For example, the non-GSO applicants themselves focused on the severity of the feeder link shortage that they confront. <u>See</u> <u>e.g.</u>, Comments of Constellation, p. 56; Comments of Ellipsat, p. 25. In total, the non-GSO systems have a need for 2500 or more megahertz of bandwidth for feeder links and many of the proponents claim that they must have access to spectrum below 15 GHz.

<u>2</u>/ TRW also claims that AMSC's own system will not gain capacity by accessing the 1.6/2.4 GHz band. Comments of TRW, p. 16. This is an old argument that AMSC has already rebutted. <u>See</u> AMSC Consolidated Opposition to Petitions to Deny, File Nos. 15/16-DSS-MP-91, at 16 (filed January 31, 1992).

The comments of Comsat and the European Union demonstrate the sensitivity of the international issues that the non-GSO systems must confront if they are to be successful. AMSC is optimistic that the U.S. position will prevail, but at least in the interim, the non-GSO system stand merely as proposals for extraordinarily expensive domestic systems. There can be no denying that there are substantial obstacles, particularly to speedy success, and that AMSC's GSO system represents an "insurance policy" that the 1.6/2.4 GHz band will be put to use in the near future.

Another important issue that is receiving increasing attention is that of orbital debris. See e.g., New York Times, p. C1 (May 17, 1994) (attached). The FCC has a legal obligation, pursuant to a February 11, 1988 Presidential Directive, to limit the generation of space debris. See also Report on Orbital Debris, prepared for National Security Council by Interagency Group (Space) (February 1989).[3/] The problem of space debris is greatest at low-Earth orbit, where the chances of a collision are much more significant than at geostationary orbit.[4/] Moreover, if there were a collision at low-Earth orbit, the impact on other

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3/ AMSC understands that the Office of Science and Technology Policy is in the process of preparing a report updating the 1989 report.

4/ In addition to there being less of a risk generally of collision at geostationary orbit, AMSC's operational plan (typical for GSO satellites) calls for saving sufficient fuel for the end of its satellites' useful lives, to be used to boost the satellite a 100 miles or so further from the Earth, where a collision is even more unlikely and any collision would not have any affect on other satellites.

systems operating there, including vital weather satellites, would be catastrophic. Again, AMSC does not mean to suggest that this and other problems faced by the non-GSO systems are not susceptible to being resolved, but the Commission should face up to the existence of these problems and consider the benefits of preserving the eligibility of an applicant whose system does not present these problems.

Conclusion

Therefore, based on the foregoing, AMSC urges the Commission to permit AMSC's GSO system to remain eligible to use the 1.6/2.4 Ghz bands.

Respectfully submitted,

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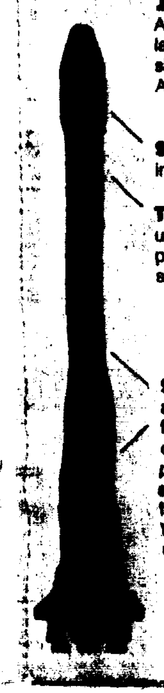
June 20, 1994

The New York Times
May 17, 1994

Fragmenting Space Debris Could Put Satellites at Risk

Space Explosion: a Case Study More than 7,000 pieces of trackable debris are circling the Earth, creating hazards for spacecraft now in orbit and for new missions. Here is the path of debris from just one mission, Ariane flight 16, a European venture that placed a commercial observation satellite in orbit about 500 miles above the Earth in 1986.



By WILLIAM J. BROAD

CHAIN reactions are rather commonplace on earth. They occur in chemical plants when a single excited molecule prompts its neighbors into a cascade of combination to create plastics. In nuclear reactors, they occur whenever a speeding subatomic particle slams into a heavy atom and splits it apart, releasing more particles that repeat and amplify the process in bursts of energy. By definition, chain reactions are spectacles of intensification, at times spreading like wildfire through dry grass.

Now, experts say, a dangerous new kind of chain reaction is getting under way in space, where it threatens to limit or end certain aspects of mankind's endeavors beyond the planet. For instance, it could put billions of dollars worth of advanced communication and weather satellites at risk of destruction.

The problem is that some orbits near Earth have become junkyards of dead and active satellites, spent rocket stages and billions of bits of whirling debris. The trashing of the heavens has reached the point where a speeding scrap of metallic refuse could hit a large object, shattering it into hundreds of pieces that repeat and amplify the process in a cascade of destruction. A chain reaction of this sort begins at a point known as the critical density.

"The consensus is that we're at the critical density, or very close to it," said Dr. Donald J. Kessler, the senior scientist for orbital-debris studies at the National Aeronautics and Space Administration. "Even if we stopped putting things into orbit, you'd still see the population increase because of random collisions."

Several satellites over the years have been lost to unknown causes and may well be the first victims of space junk.

Any chain of orbital destruction would be far slower than reactions on earth because the distances in space are so vast. Ruin on a widespread scale would take decades. But the implications for commerce, science and the military would nonetheless be enormous. Crowded orbits, which have no substitutes for some missions, would doubtless have to be abandoned to lessen the risk of collision.

The trashing of the heavens may force NASA to act.

That threat is prompting unusual action among space organizations, which in the past have tended to pay lip service to the problem. In the vanguard is NASA, which has raised debris mitigation to a high policy goal and is drawing up a detailed rule book for its spacecraft designers, launchers and operators. The agency is considered likely to set the pace for all Federal space procurements, including weather and military satellites.

The big unknown is not so much foreign governments, which are also wrestling with the problem, but the commercial sector, which represents a growing share of the orbital pie as businesses plan new generations of communication satellites. The question is whether the significant costs of doing things the right way will be paid voluntarily as global competition rises and profit margins become razor-thin.

"Right now debris mitigation is not part of the culture," said John E. Pike, head of space policy for the Federation of American Scientists, a private group based in Washington.

Continued on Page C8

The New York Times; Illustration by Frank O'Connell

Growing Space Debris Could Put Satellites at Risk, Experts Warn

Continued From Page C1

"It's going to be like environmental regulation everywhere. First people cry in the wilderness, saying there's a problem. Then comes the natural progression of doing the easy things, and then the harder things that tend to cost more."

From the start of the space age, orbits near Earth have steadily become more and more littered, often by the intentional discarding of lens caps, packing material, fuel tanks and payload covers. A different kind of intentional debris was generated in 1985 when the Reagan Administration smashed a spacecraft to bits while testing an anti-satellite weapon, creating some 285 trackable pieces of whirling junk.

But the rubbish that is accumulating fastest today is the kind made inadvertently. For instance, the third stage of an Ariane rocket engine exploded in orbit in November 1986, creating 465 pieces of speeding debris that spun about Earth. Another Ariane upper stage shattered last month, creating nine trackable items. And last week sensors on the ground detected the breakup of a Russian rocket stage high above Earth. So far that event has produced 38 observable bits of debris.

The overall problem first got serious attention in the 1980's as the tide of refuse and spacecraft became tangibly thicker. Ground-based radars, the main tool for assessing the mess, found steady rises in large pieces of trackable debris, which ranged in size from softballs to large habitats for astronauts.

Invisible Swarms of Junk

Scientists also began to discover that below the threshold of routine detectability was a swarm of billions of bits of speeding trash that ranged in size from small rocks to grains of sand. For instance, space shuttles often came back from orbit disfigured by impact craters, as did a few satellites returned to Earth for refurbishment and evaluation. Eventually, the riot of nearly invisible refuse was estimated to make up the vast majority of man-made material in orbit. In contrast, the 7,000 or so large objects trackable by radar were judged to represent less than 1 percent of the total mass.

On Feb. 11, 1988, President Ronald Reagan issued a directive ordering all Federal agencies to limit the generation of space debris. But in practice, little changed.

A January 1989 report for the White House National Security Council painted a bleak picture, saying experts increasingly feared that small and large objects would inevitably collide, "producing additional fragments and causing the total debris population to grow."

The danger, according to the 1989 report, was that even tiny debris packed a mean punch because of the enormous speeds of most everything in orbit. A tiny aluminum sphere could harbor the energies of an exploding hand grenade.

"It is reasonable to expect significant structural damage," the report warned, if such a speeding particle hit a large spacecraft.

The 1989 report warned that fragmentations were rising, particularly in low orbits. "This increase," it warned, "represents a potential threat to the safety of manned operations in space."

After years of Federal inactivity, if not apathy, Daniel S. Goldin, NASA's Administrator, spelled out a high-level agency policy in April 1993 "to employ design and operations practices that limit the generation of orbital debris, consistent with mission requirements and cost-effectiveness." It was the first such declaration by a Federal agency.

Study of Debris Threat

NASA also paid the National Academy of Sciences to assess the debris threat in a study that began last August and is to be completed this year. The academy, a private group, often advises the Government on science issues. The emerging consensus of the 10-member debris panel is said to be that a chain reaction is either already under way or is likely to get started in the near future.

Dr. Kessler of NASA, a member of the academy panel, said the situation was so bleak that even if nothing else were launched into space, a cascade of destruction would cause a doubling of the numbers of pieces of flying debris in some crowded orbits over the next 100 years. He added that if launchings continued at their current rate, each year adding to the trackable group of debris some 400 items (1,000 newcomers and 600 dropouts that burn up in the atmosphere), then the chain reaction would cause those same orbits to become 10 times as crowded.

"It's clearly wiser to avoid a tenfold increase," Dr. Kessler said.

Nicholas L. Johnson, an orbital debris expert at the Kaman Sciences Corporation, in Colorado Springs, another member of the academy panel, said he felt there was not enough evidence to judge whether a chain reaction had already begun. In any case, he said, its repercussions might not materialize for decades.

"From an operational standpoint I think we're not going to have to worry about losing satellites in my lifetime," he said. "I don't think it's imminent."

But Mr. Johnson also called for stepped-up measures to reduce the generation of debris, saying, "That only makes sense as the responsible thing to do."

NASA headquarters is now drafting rules that could substantially change the design and operation of its spacecraft. If anything, its authors say, the handbook could be overly ambitious. "We may be pushing for too much," said Wayne Frazier, who directs the work at NASA's office of Safety and Mission Assurance in Washington. "We have to walk before we run," he said, adding that the requirements would be gradually introduced to minimize costs.

The easiest step would be to vent residual propellant from the fuel tanks of third-stage engines after their payloads have successfully been placed in space. The results might be striking, experts say, since the explosion of spent upper stages to date has been the main source of debris in low orbits.

Whirling debris smashing into more debris is creating orbiting junkyards.

A More Expensive Alternative

A more costly step would involve moving spacecraft out of harm's way as missions are accomplished, either into less-crowded parking orbits or downward into Earth's atmosphere, where they would burn up. This option could be costly, since a spacecraft would have to have engines and enough fuel to accomplish such post-mission goals.

"Depending on what altitude you're at, the amount of propellant could be 5 or 10 percent of a satellite's overall mass," Mr. Johnson of Kaman Sciences said. "That's not an insignificant amount."

The most expensive option of all would be to redesign spacecraft from top to bottom to limit debris, possibly by adding protective shields that would ward off tiny projectiles and keep a satellite from shattering.

Mr. Frazier, who directs the work at NASA headquarters, said the gradual adoption of such rules would be far easier if they were required internationally, perhaps by a body like the United Nations. Otherwise, competitive pressures around the globe to keep down costs would continue to erode the steps needed to limit the rising tide of orbital trash.

"The sooner we can get agreement on international policy the better," he said. "They all realize they have to do it because they have to live there. But nobody wants to be first."

Technical Appendix

TECHNICAL APPENDIX

I. NO TECHNICAL ADVANTAGES HAVE BEEN SHOWN FOR NON-GEOSTATIONARY MSS NETWORKS

In their comments, some of the non-geostationary ("non-GSO") MSS satellite applicants claim that their systems will be superior to GSO MSS systems as a result of lower time delay and their ability to serve handheld terminals without large satellite antennas. To the contrary, AMSC demonstrated that these time delay comparisons indicate no design or performance advanages for any particular MSS satellite orbit. Comments, Technical Appendix, at 1-4. Moreover, the large antennas needed for GSO satellite service to handheld terminals are no more difficult to implement today than they were twenty years ago when NASA first demonstrated handheld MSS using the ATS-6 geostationary satellite. Thus, no advantages can be accrued from these differences in non-GSO and GSO systems.

LQP alleges that lack of transmission delay in non-GSO systems improves the interoperability of satellite and terrestrial mobile systems and TRW asserts that lower transmission delay in non-GSO systems will yield perceptibly better performance.[1] As an initial matter, the transmission delay estimates made by LQP and TRW are incomplete and over optimistic.[2] To the typical consumer, the differences that exist in the transmission delay of AMSC's systems and the proposed non-GSO systems will be imperceptible. In designing and constructing its first

1 Comments of LQP, at 12, and Comments of TRW, Inc., at 18.

2 LQP estimates that the total transmission delay in a non-GSO system is comprised of 18 msec. of propagation delay and 100 msec. of digital processing delay. However, additional buffering delay is needed in non-GSO systems (but not in GSO systems) in order to enable the non-GSO satellite handoffs to appear "seamless" to the users. See Comments of AMSC, Technical Appendix, Table 1. TRW does not include any processing delay in its estimate, which yields an exaggerated difference between the transmission delay in non-GSO and GSO systems.

generation GSO system to be interoperable with terrestrial cellular systems, AMSC has encountered no difficulties due to time delay in its transmission links and it is not at all clear what difficulties LQP imagines. Whether the system is GSO or non-GSO, decisions for design variables that affect transmission delay (e.g., interleaving depth) are made in light of the inherent signal propagation delay in a manner that yields acceptable overall transmission delay. Thus, the effect of differences in the signal propagation delay associated with each of the proposed MSS systems is to alter the tradeoffs that are made in selecting certain system parameter values. Moreover, neither commenter provided any technical evidence to substantiate their claims and both disregarded technical access delay which is inherently lower for GSO systems.

In contrast to the charactizations made by CCI and LQP, no disadvantage for GSO MSS satellites is incurred by the fact that a GSO satellite requires a larger antenna than a non-GSO satellite in order to serve handheld terminals.[3] In the context of global service to handheld mobile terminals with common features, the tradeoffs involving satellite antenna size could be reduced to a set choices between a few satellites (e.g., four) with larger antennas (e.g., 30 feet); several satellites (e.g., twelve) in intermediate orbit with smaller antennas (e.g., ten feet); or numerous satellites (e.g., forty eight) in low orbit with smaller antennas. Thus, the need for a large antenna on a GSO satellite is offset by the need for fewer satellites. Moreover, in its proposed PCSAT system that will provide service to handheld terminals, AMSC will employ a larger antenna than was used by NASA for experimental service to handheld terminals.[4]

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3 Comments of Constellation Communications, In.c ("CCI"), at 7, and LQP, at 12.

4 NASA's ATS-6 satellite was equipped with a nine meter antenna and used to serve handheld mobile terminals in the mid- to late 1970s. AMSC's proposed PCSAT satellites will use

II. KEY NON-GSO MSS FREQUENCY SHARING ISSUES REMAIN UNRESOLVED

The comments reflect general agreement as to how the 1610-1626.5 MHz band can be shared in the US between MSS and the radio astronomy.[5] However, inter-service sharing problems with respect to the fixed and radionavigation services at 1610-1626.5 MHz and the fixed, mobile, and radiolocation services and ISM at 2483.5-2500 MHz remain unresolved. The non-GSO MSS applicants have completely ignored foreign mobile and radiolocation operations in the 2483.5-2500 MHz band, whichpose no problems for AMSC's proposed system.[6] Their treatment of fixed services in both the 1610-1626.5 MHz and 2483.5-2500 MHz bands is superficial and in some cases at odds with internationally agreed sharing principles. Although the comments indicate potential solutions for sharing at 1610-1626.5 MHz with radionavigation-satellite services in the US, the same solutions may not be workable outside the US and the non-GSO applicants have ignored the problem of radars in Europe. As demonstrated by AMSC and admitted in certain other comments, interference between the proposed non-GSO systems and current and future systems operating in other services will preclude MSS or severely limit

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ten meter antennas. See Application of Personal Communications Satellite Corp., filed April 7, 1994..

5 All commenters agree that protection zones around radio astronomy observatories should be observed in the 1610.6-1613.8 MHz band; however, there is some disagreement regarding protection of radio astronomy from mobile earth station transmissions operating in other parts of the 1610-1626.5 MHz band.

6 AMSC's satellite antenna will provide discrimination sufficient to preclude interference to foreign mobile and radioloaction systems. The available geographic separation between AMSC's mobile earth stations and foreign mobile and radiolocation systems will be sufficient to preclude interference.

capacity or service quality in many areas outside the US.[7] Some of these problems are further discussed below.[8]

A. Sharing With the Fixed Service at 1610-1626.5 MHz

Rather than showing that the necessary sharing constraints will have acceptable impact, CCI opposes the proposed Section 25.213(d) requiring protection of fixed stations operating outside the United States under RR No. 730. Comments, at 53. CCI and the other non-GSO MSS applicants apparently fail to realize that interference to or from fixed stations operating in forty nine countries under RR Nos. 727 and 730 likely will preclude MSS or limit the capacity or quality of service in the1610-1626.5 MHz band throughout much of Europe, Africa and Asia. These fixed systems are not visible to AMSC's satellite and pose no problems for AMSC's proposed system.

B. Sharing With the Fixed Service at 2483.5-2500 MHz

CCI, Ellipsat, and TRW propose relaxation of the power flux density ("PFD") limit needed for protection of fixed systems at 2483.5-2500 MHz, but only LQP filed an analysis portending to show this to be feasible.[9] However, the LQP analysis actually supports just the opposite conclusion -- that PFD limits for non-

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7 See Comments of AMSC Subsidiary Corporation, Technical Appendix, at 9 - 13, which summarize the sharing problems.

8 Task Groups 2/2 and 8/3 are addressing all of the frequency sharing problems faced by the service links in all non-GSO systems.

9 See comments of Ellipsat, at 23; LQP at 73-76 and Attachment 2 to Technical Appendix; and TRW, at 129-131.

GSO satellites must be tightened rather than relaxed. LQP's analysis fails to address digital line-of-sight fixed systems, which cannot tolerate PFD levels as high as those associated with the analog systems addressed by LQP.[10] In addition, the LQP analysis fails to consider the protection requirements of either analog or digital transhorizon and point-to-multipoint systems in the fixed service, as specified in Doc. 2-2/TEMP/8 of TG 2/2 which is addressing the PFD issue. Moreover, even if analog line-of-sight systems could be used as the sole basis for establishing appropriate PFD limits, LQP's analysis and the proposed PFD relaxation does not take account of the need to protect fixed stations from the interference caused by all non-GSO systems.[11]

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10 See Liaison Statement from ITU-R Working Party 9D to TG 2-2 (TG 2-2 document number not yet assigned).

11 The LQP analysis assumes that its system is the only interferer, even though four co-frequency non-GSO systems and AMSC's GSO system would concurrently cause interference. Assuming that LQP's analysis of its interference to an analog line-of-sight system is correct, the resulting limiting PFD levels would need to be reduced by approximately 10 log [number of MSS systems] in order to allow systems other than LQP's system to use the band. For example, if there were five MSS systems using the 2483.5-2500 MHz band, the PFD limit would have to be of the order of -149 $dBW/m^2/4$ kHz at high angles of elevation, which represents a tightening rather than relaxation of the PFD limit.

DECLARATION

I, Thomas M. Sullivan, do hereby declare as follows:

1. I have a Bachelor of Science degree in Electrical Engineering and have taken numerous post-graduate courses in Physics and Electrical Engineering.

2. I am presently employed by Computer Sciences Corporation and was formerly employed by the IIT Research Institute, DoD Electromagnetic Compatibility Analysis Center.

3. I received in 1982 an official commendation from the Department of the Army for the establishment of worldwide accommodations for mobile earth stations.

4. I am qualified to evaluate the technical information in the Reply Comments of American Mobile Satellite Corporation. I am familiar with the Manual of Regulations and Procedures for Federal Radio Frequency Management.

5. I have first-hand experience in the coordination of frequency assignments for mobile satellite systems.

6. I have been involved in the preparation and have reviewed the Reply Comments of American Mobile Satellite Corporation. The technical facts contained therein are accurate to the best of my knowledge and belief.

Under penalty of perjury, the foregoing is true and correct.

June 20, 1994
Date

Thomas M. Sullivan
Thomas M. Sullivan

CERTIFICATE OF SERVICE

I, Cynthia L. Smith, a secretary in the law firm of Fisher Wayland Cooper Leader & Zaragoza L.L.P. do hereby certify that on this 20th day of June 1994, a copy of the foregoing "Reply Comments of AMSC Subsidiary Corporation" was sent by U.S. first class mail, postage prepaid to:

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